

REMARKS

The Examiner is thanked for the thorough examination of this application. The FINAL Office Action, however, has rejected all pending claims 29-34 and 36-38. Applicants have amended claims herein to clearly define over the cited art of record, and Applicants file this amendment along with an RCE application.

Rejections Under 35 U.S.C. 102(b)

Claims 29-34, 36-38 are rejected under 35 U.S.C 102(b) as allegedly anticipated by Beddingfield (U.S. Patent No. 5,977,632). Applicants respectfully traverse the rejections made by the Office Action for the reasons discussed below.

In this regard, Beddingfield discloses a flip chip bump structure and method of making same. Specifically, referring to Figs. 4-5, and col. 3, lines 51-55, Beddingfield teaches a UBM structure 22, which is illustrated to exist within the perimeter of the conductive portion 12, and the perimeter of the UBM structure 24 is illustrated to exist outside the perimeter of the conductive portion 13. Ball-liked bump structures 26 and 28 are formed on the UBM structures 22 and 24.

In contrast, amended claims 29 and 37-38 recite:

29. A solder bump for interconnection of flip chip devices comprising:
a semiconductor surface;
at least one contact pad over said semiconductor surface;
a passivation layer over said semiconductor surface, said passivation layer exposing said at least one contact pad;
an Under-Bump-Metallurgy (UBM) layer over said layer of passivation and said at least one contact pad, lateral dimension of the UBM layer being limited to be within lateral dimension of the at least one contact pad; and
at least one solder compound overlying the UBM layer, wherein *the solder compound comprises a flat top surface*, a flat bottom surface and convex

sidewalls before connecting to other components, *wherein the flat top surface is greater than the flat bottom surface.*

37. A solder bump for interconnection of flip chip devices comprising:
a semiconductor surface;
at least one contact pad over said semiconductor surface;
a passivation layer over said semiconductor surface, said passivation layer exposing said at least one contact pad;
an Under-Bump-Metallurgy (UBM) layer over said passivation layer and said at least one contact pad, lateral dimension of the UBM layer being limited to a size approximately the same as lateral dimension of the at least one contact pad; and
at least one solder compound overlying the UBM layer, wherein *the solder compound comprises a flat top surface*, a flat bottom surface and convex sidewalls before connecting to other components, *wherein the flat top surface is greater than the flat bottom surface.*

38. A solder bump for interconnection of flip chip devices comprising:
a semiconductor surface;
at least one contact pad over said semiconductor surface;
a passivation layer over said semiconductor surface, said passivation layer exposing said at least one contact pad;
an Under-Bump-Metallurgy (UBM) layer over said passivation layer and said at least one contact pad; and
at least one solder compound overlying the UBM layer, wherein the solder compound comprises a flat top surface, a flat bottom surface and convex sidewalls before connecting to other components, *wherein the flat top surface is greater than the flat bottom surface.*

(*Emphasis added.*)

Clearly, Beddingfield does not teach or suggest “the solder compound comprising a flat top surface” or that “the flat top surface is greater than the flat bottom surface,” as specifically defined in the amended claims. For at least this reason, the amended claims patently define over the cited art.

Indeed, Beddingfield only teaches ball-liked bump structures 26 and 28 that are formed on the UBM structures 22 and 24. However, the bump structures 26 or 28 do not have a “flat top

surface.” Further, even if the top surface of the “ball-liked” bump structure 26 or 28 is “flat” in a very narrow area, the “flat” top surface of the bump structure 26 or 28 is still NOT greater than the flat bottom surface of the bump structure 26 or 28. As amended, the claims clearly make this distinction, and define over the cited art. Therefore, Applicants respectfully assert that the amended claims 29 and 37-38 are in condition for allowance.

As claims 30-34 and 36 are dependent claims that incorporate the features/limitations of claim 29, these claims also are in condition for allowance.

Rejections Under 35 U.S.C. 102(e)

Claims 29 and 37-38 were rejected under 35 U.S.C 102(e) as allegedly anticipated by Fang (U.S. Patent No. 6,737,353). Applicants respectfully traverse the rejections made by the Office Action for at least the reasons discussed below.

In this regard, Fang discloses a semiconductor device having bump electrodes. Specifically, referring to Fig. 6, Fang teaches a gold bump 150 acting as a bump electrode formed on the titanium layer 140c, wherein the gold bump 150 is square-liked gold bump with straight sidewalls.

In contrast, amended claims 29 and 37-38 recite:

29. A solder bump for interconnection of flip chip devices comprising:
a semiconductor surface;
at least one contact pad over said semiconductor surface;
a passivation layer over said semiconductor surface, said passivation layer exposing said at least one contact pad;
an Under-Bump-Metallurgy (UBM) layer over said layer of passivation and said at least one contact pad, lateral dimension of the UBM layer being limited to be within lateral dimension of the at least one contact pad; and
at least one solder compound overlying the UBM layer, wherein *the solder compound comprises* a flat top surface, a flat bottom surface and *convex*

sidewalls before connecting to other components, wherein the flat top surface is greater than the flat bottom surface.

37. A solder bump for interconnection of flip chip devices comprising:
a semiconductor surface;
at least one contact pad over said semiconductor surface;
a passivation layer over said semiconductor surface, said passivation layer exposing said at least one contact pad;
an Under-Bump-Metallurgy (UBM) layer over said passivation layer and said at least one contact pad, lateral dimension of the UBM layer being limited to a size approximately the same as lateral dimension of the at least one contact pad; and
at least one solder compound overlying the UBM layer, wherein *the solder compound comprises* a flat top surface, a flat bottom surface and *convex sidewalls before connecting to other components*, wherein the flat top surface is greater than the flat bottom surface.

38. A solder bump for interconnection of flip chip devices comprising:
a semiconductor surface;
at least one contact pad over said semiconductor surface;
a passivation layer over said semiconductor surface, said passivation layer exposing said at least one contact pad;
an Under-Bump-Metallurgy (UBM) layer over said passivation layer and said at least one contact pad; and
at least one solder compound overlying the UBM layer, wherein *the solder compound comprises* a flat top surface, a flat bottom surface and *convex sidewalls before connecting to other components*, wherein the flat top surface is greater than the flat bottom surface.

(*Emphasis added.*)

Clearly, Fang does not teach or suggest the claimed feature of “the solder compound comprises convex sidewalls before connecting to other components”. Indeed, Fang only teaches the gold bump 150 being square-liked, having straight sidewalls. Consequently, the gold bump 150 of Fang does not have “convex sidewalls” as specifically claimed, and therefore it is different from the claimed invention.

Applicants respectfully submit that Fang is deficient for the purpose of anticipating claims 29 and 37-38 for at least the reason that Fang does not disclose or teach the

features/limitations emphasized above. Therefore, Applicants respectfully assert that the amended claims 29 and 37-38 are in condition for allowance.

As claims 30-34 and 36 are dependent claims that incorporate the features/limitations of claim 29, these claims also are in condition for allowance.


CONCLUSION

In view of the foregoing, it is believed that all pending claims are in proper condition for allowance. If the Examiner believes that a telephone conference would expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

No fee is believed to be due in connection with this amendment and response to Office Action. If, however, any fee is believed to be due, you are hereby authorized to charge any such fee to deposit account No. 20-0778.

Respectfully submitted,

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